No. 9100156

THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

Pioneer Hi-Bred International, Inc.

Whereas, THERE HAS BEEN PRESENTED TO THE

Secretary of Agriculture

AN APPLICATION REQUESTING A CERTIFICATE OF PROTECTION FOR AN ALLEGED NOVEL VARIETY OF SEXUALLY REPRODUCED PLANT, THE NAME AND DESCRIPTION OF WHICH ARE CONTAINED IN THE APPLICATION AND EXHIBITS, A COPY OF WHICH IS HEREUNTO ANNEXED AND MADE A PART HEREOF, AND THE VARIOUS REQUIREMENTS OF LAW IN SUCH CASES MADE AND PROVIDED HAVE BEEN COMPLIED WITH, AND THE TITLE THERETO IS, FROM THE RECORDS OF THE PLANT VARIETY PROTECTION OFFICE, IN THE APPLICANT(S) INDICATED IN THE SAID COPY, AND WHEREAS, UPON DUE EXAMINATION MADE, THE SAID APPLICANT(S) IS (ARE) ADJUDGED TO BE ENTITLED TO A CERTIFICATE OF PLANT VARIETY PROTECTION UNDER THE LAW.

NOW, THEREFORE, THIS CERTIFICATE OF PLANT VARIETY PROTECTION IS TO GRANT UNTO THE SAID APPLICANT(S) AND THE SUCCESSORS, HEIRS OR ASSIGNS OF THE SAID APPLICANT(S) FOR THE TERM OF *eighteen* YEARS FROM THE DATE OF THIS GRANT, SUBJECT TO THE PAYMENT OF THE REQUIRED FEES AND PERIODIC REPLENISHMENT OF VIABLE BASIC SEED OF THE VARIETY IN A PUBLIC REPOSITORY AS PROVIDED BY LAW, THE RIGHT TO EXCLUDE OTHERS FROM SELLING THE VARIETY, OR OFFERING IT FOR SALE, OR REPRODUCING IT, IMPORTING IT, OR EXPORTING IT, OR USING IT IN PRODUCING A HYBRID OR DIFFERENT VARIETY THEREFROM, TO THE EXTENT PROVIDED BY THE PLANT VARIETY PROTECTION ACT (84 STAT. 1542, AS AMENDED, 7 U.S.C. 2321 ET SEQ.)

ALFALFA

'5333'

In Testimony Whereof, *I have hereunto set my hand and caused the seal of the* Plant Variety Protection Office *to be affixed at the City of* Washington, D.C. *this* 31st *day of* August *in the year of our Lord one thousand nine hundred and* ninety-three.

Attest:

Kenneth A. Evans

Commissioner
Plant Variety Protection Office
Agricultural Marketing Service

Mike Espy

Secretary of Agriculture

FORM APPROVED: OMB 0581-0055, Expires 1/31/91

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE

APPLICATION FOR PLANT VARIETY PROTECTION CERTIFICATE

(Instructions on reverse)

Application is required in order to determine if a plant variety protection certificate is to be issued (7 U S C 2421). Information is held confidential until certificate is issued (7 U.S C 2426).

1. NAME OF APPLICANT(S) *(as it is to appear on the Certificate)*
Pioneer Hi-Bred International, Inc.

2. TEMPORARY DESIGNATION OR EXPERIMENTAL NO.
XAM84

3. VARIETY NAME
5333

4. ADDRESS *(street and no. or R.F.D. no., city, state, and ZIP)*
7305 N. W. 62nd Avenue, P.O. Box 287
Johnston, IA 50131

5. PHONE *(Include area code)*
515-270-3340

FOR OFFICIAL USE ONLY

PVPO NUMBER
9100156

FILING — Date: March 27, 1991 — Time: ☐ AM ☐ PM

FEES RECEIVED — Filing and Examination Fee: $ 2150.00 — Date: March 27, 1991 — Certificate Fee: $ 250.00 — Date: Aug. 5, 1993

6. GENUS AND SPECIES NAME
Medicago sativa

7. FAMILY NAME *(Botanical)*
Leguminosae

8. CROP KIND NAME *(Common Name)*
Alfalfa

9. DATE OF DETERMINATION
August, 1986

10. IF THE APPLICANT NAMED IS NOT A "PERSON," GIVE FORM OF ORGANIZATION *(Corporation, partnership, association, etc.)*
Corporation

11. IF INCORPORATED, GIVE STATE OF INCORPORATION
Iowa

12. DATE OF INCORPORATION
1926

13. NAME AND ADDRESS OF APPLICANT REPRESENTATIVE(S), IF ANY, TO SERVE IN THIS APPLICATION AND RECEIVE ALL PAPERS

William T. W. Woodward, 7305 N. W. 62nd Avenue, P. O. Box 287, Johnston, IA 50131
Mary Helen Mitchell, 700 Capital Square, 400 Locust Street, Des Moines, IA 50309
John Hintze, 700 Capital Square, 400 Locust Street, Des Moines, IA 50309
PHONE *(Include area code)*:

14. CHECK APPROPRIATE BOX FOR EACH ATTACHMENT SUBMITTED *(Follow INSTRUCTIONS on reverse)*

- a. ☒ Exhibit A, Origin and Breeding History of the Variety.
- b. ☒ Exhibit B, Novelty Statement.
- c. ☒ Exhibit C, Objective Description of Variety.
- d ☒ Exhibit D, Additional Description of Variety.
- e ☒ Exhibit E, Statement of the Basis of Applicant's Ownership.
- f ☒ Seed Sample (2,500 viable untreated seeds) Date Seed Sample mailed to Plant Variety Protection Office March 13, 1991
- g ☒ Filing and Examination Fee ($2,150) made payable to "Treasurer of the United States."

15. DOES THE APPLICANT(S) SPECIFY THAT SEED OF THIS VARIETY BE SOLD BY VARIETY NAME ONLY AS A CLASS OF CERTIFIED SEED? *(See section 83(a) of the Plant Variety Protection Act.)*
☐ YES *(If "YES," answer items 16 and 17 below)* ☒ NO *(If "NO," skip to item 18 below)*

16. DOES THE APPLICANT(S) SPECIFY THAT THIS VARIETY BE LIMITED AS TO NUMBER OF GENERATIONS?
☒ YES ☐ NO

17. IF "YES" TO ITEM 16, WHICH CLASSES OF PRODUCTION BEYOND BREEDER SEED?
☒ FOUNDATION ☐ REGISTERED ☒ CERTIFIED

18. DID THE APPLICANT(S) PREVIOUSLY FILE FOR PROTECTION OF THE VARIETY IN THE U.S.?
☐ YES *(If "YES," through)* ☐ Plant Variety Protection Act ☐ Patent Act Give date. _____
☒ NO

19. HAS THE VARIETY BEEN RELEASED, USED, OFFERED FOR SALE, OR MARKETED IN THE U.S. OR OTHER COUNTRIES?
☒ YES (If "YES," give names of countries and dates)
☐ NO U. S. A. Spring of 1991

20. The applicant(s) declare(s) that a viable sample of basic seeds of this variety will be furnished with the application and will be replenished upon request in accordance with such regulations as may be applicable.

The undersigned applicant(s) is (are) the owner(s) of this sexually reproduced novel plant variety, and believe(s) that the variety is distinct, uniform, and stable as required in section 41, and is entitled to protection under the provisions of section 42 of the Plant Variety Protection Act.

Applicant(s) is (are) informed that false representation herein can jeopardize protection and result in penalties.

SIGNATURE OF APPLICANT *(Owner(s))*	CAPACITY OR TITLE	DATE
PIONEER HI-BRED INTERNATIONAL, INC.		
SIGNATURE OF APPLICANT *(Owner(s))* BY William T.W. Woodward	CAPACITY OR TITLE Director, Department of Alfalfa Breeding	DATE 3-12-91

FORM CSSD-470 (5-89) Edition of FORM LS-470, 3-86, is obsolete.

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EXHIBIT A

ORIGIN AND BREEDING HISTORY OF THE VARIETY

'5333'

5333 is a synthetic variety comprised from 145 plants originating from experimental lines tracing to 5432 (10%), 532 (7%), 120 (7%), 524 (6%), NCMP10 (6%), MSACW3AN4 (4%), Vernal (5%), Armor (3%), Magnum (3%), Mercury (2%), 5444 (2%), Apollo (2%), 521 (2%), Agate (2%), Endure (1%), Futura (1%), 526 (1%), 5364 (1%), 555 (1%), B7AC3AN1 (1%). The remainder trace through Pioneer experimentals to Honeoye, Europe, Vertus, Daer Feldt, Culver, MSA-C4, MSB-C4, 520, Iroquois, Narragansett, Team, Cherokee, Arnim, Saranac AR, Dawson, Anchor, DuPuits, 530, 521 and others with minor contributions. Parent plants were selected through phenotypic recurrent selection from various experimental populations for one or more of the following: Bacterial wilt, Fusarium wilt, anthracnose, Verticillium wilt, Phytophthora root rot and expression of multifoliolate leaves. Syn 1 seed harvested from parental plants in 1986 and 1987 in cage isolation is considered breeder seed.

During seed multiplication no variates beyond the limits defined under Exhibit C have been found. Multiplication procedures will insure that seed being sold as 5333 will not be shifted in characteristics beyond presently acceptable limits for alfalfa varieties.

It is confirmed that 5333 meets presently acceptable levels of uniformity for alfalfa varieties.

EXHIBIT B

NOVELTY STATEMENT

'5333'

5333 most closely resembles the variety '5331'. 5333 differs from 5331 in pea aphid resistance being classified as having high resistance, while 5331 has moderate resistance.

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
LIVESTOCK, MEAT, GRAIN & SEED DIVISION
PLANT VARIETY PROTECTION OFFICE
BELTSVILLE, MARYLAND 20705

EXHIBIT C

OBJECTIVE DESCRIPTION OF VARIETY
ALFALFA *(Medicago sativa* sensu Gunn et al.*)*

NAME OF APPLICANT(S)	TEMPORARY DESIGNATION	VARIETY NAME
Pioneer Hi-Bred International, Inc.	XAM84	5333

ADDRESS *(Street and No., or R.F.D. No., City, State, and Zip Code)*
7305 N. W. 62nd Avenue, P. O. Box 287
Johnston, IA 50131

FOR OFFICIAL USE ONLY
PVPO NUMBER
9100156

PLEASE READ ALL INSTRUCTIONS CAREFULLY: Place numbers in the boxes to designate the expressions which are characteristic of the commerical generations of the application variety. Data for quantitative plant characters should be based on a minimum of 100 plants. Include leading zeros when necessary (e.g., [0][8][9]) for quantitative data. Comparative data should be determined from varieties entered in the same trial. Plant color may be precisely designated by using any recognized color chart, e.g., The Munsell Plant Tissue Color Charts.

1. WINTERHARDINESS:

[7] CLASS:
1 = Very Non-Winterhardy (CUF 101)
2 = Non-Winterhardy (Moapa 69)
3 = Intermediately Non-Winterhardy (Mesilla)
4 = Semi-Winterhardy (Lahontan)
5 = (Du Puits)
6 = Moderately Winterhardy (Saranac)
7 = (Ranger)
8 = Winterhardy (Vernal)
9 = Extremely Winterhardy (Norseman)

TEST LOCATION: Owatonna, MN

2. FALL DORMANCY:

FALL DORMANCY (DETERMINED FROM SPACED PLANTINGS)

TESTING INSTITUTION AND LOCATION	DATE OF LAST CUT	DATE REGROWTH SCORED	REGROWTH SCORE OR AVERAGE HEIGHT				LSD .05
			APPLICATION VARIETY	CHECK VARIETIES*			
				Vernal	Ranger	Saranac	
Pioneer Hi-Bred International, Inc. Johnston, IA	9/14/90	10/12/90	11.2	8.4	9.7	11.8	1.4

* CUF 101, Moapa 69, Mesilla, Lahontan, Du Puits, Saranac, Ranger, Vernal, or Norseman as appropriate.

Specify scoring system used: Average height in cm of space plants

[5] Fall Growth Habit (Determined from Fall Dormancy Trials)
1 = Erect (CUF 101)
3 = Semierect (Mesilla)
5 = Intermediate (Saranac)
7 = Semidecumbent (Vernal)
9 = Decumbent (Norseman)

3. RECOVERY AFTER FIRST SPRING CUT (In Southwest, first cut after March 21):

[3]
1 = Very Fast (CUF 101)
3 = Fast (Saranac)
5 = Intermediate (Ranger)
7 = Slow (Vernal)
9 = Very Slow (Norseman)

TEST LOCATION: Johnston, IA

4. AREAS OF ADAPTATION IN U.S. (Where tested and proven adapted):

[1] Primary Area of Adaptation

[2][6] Other Areas of Adaptation

1 = North Central
2 = East Central
3 = Southeast
4 = Southwest
5 = Moderately Winterhardy Intermountain
6 = Winterhardy Intermountain
7 = Great Plains
8 = Other *(Specify)* _____

5. FLOWERING DATE (When 10% of plants possess open flowers at time of first spring cut):

[ ][ ] Days Earlier Than . . . . . [ ]
Same As . . . . . [3]
[ ][ ] Days Later Than . . . . . [ ]

1 = CUF 101
2 = Mesilla
3 = Saranac
4 = Vernal
5 = Norseman

TEST LOCATION: Connell, WA Johnston, IA

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6. PLANT COLOR (Determined from healthy regrowth 3 weeks after first spring cut, controlling leafhoppers if necessary)

[ ] 1 = Very Dark Green (S24) 2 = Dark Green (Vernal) 3 = Light Green (Ranger)

COLOR CHART VALUE (Specify chart used): _____

APPLICATION VARIETY: _____

VERNAL: _____

TEST LOCATION: _____

7. CROWN TYPE (Determined from spaced plantings):

[ ] Noncreeping Types: 1 = Broad (Vernal) 2 = Intermediate (Saranac) 3 = Narrow (CUF 101)

Creeping Types: 4 = Creeping Rooted (Rangelander) 5 = Rhizomatous (Rhizoma)

8. FLOWER COLOR (Determine frequency of plants for each color class as defined by USDA Agriculture Handbook No. 424 (Barnes 1972), allowing all plants in plot to flower):

088 % Purple and Violet (Subclasses 1.1 to 1.4)	008 % Blue (Subclasses 2.3 and 2.4)
004 % Variegated Other Than Blue (Subclasses 2.1, 2.2, 2.5 to 2.9)	t % Yellow (Subclasses 4.1 to 4.4)
t % Cream (Class 3)	t % White (Class 5)

TEST LOCATION: Johnston, IA

9. POD SHAPE (Determine frequency of plants with the following pod shapes produced on well cross-pollinated racemes):

% Tightly Coiled (One or more coils, center more or less closed)	% Loosely Coiled (One or more coils, center conspicuously open)
% Sickle (Less than 1 coil)	TEST LOCATION: _____

10. PEST RESISTANCE: Provide in the appropriate column; trial data for application variety, and resistant (R) and susceptible (S) check varieties, synthetic generation tested, average severity index scores (ASI), least significant difference statistics (LSD .05), the institution in charge of test, year, and location of test, and whether test is a field or laboratory evaluation. Describe scoring system, and any test procedure which differs from standard methods proposed by Elgin (1982). Trial data from other test years or locations should be presented whenever available on a separate document as Exhibit D.
Seeds of the check varieties and germplasm lines listed below can be obtained from the USDA Field Crops Laboratory, Bldg. 001, Rm. 335, BARC-West, Beltsville, MD 20705. Although comparisons with check varieties listed below are preferred, comparisons with any appropriate check variety recommended by Elgin (1982) may be presented.

A. DISEASE RESISTANCE: DISEASE	VARIETY	SYN. GEN. TESTED	PERCENT RESISTANT PLANTS	NUMBER OF PLANTS TESTED	ASI	ASI LSD .05	INSTITUTION, YEAR, LOCATION, FIELD OR LABORATORY
Anthracnose, Race 1 *(Colletotrichum trifolii)*	Application HR	1	81.7	Approx 300		Percent Resistant Plants 7.8	Pioneer Hi-Bred International, Inc. 1986 Johnston, IA Laboratory
	Arc (R)		65.0	"			
	Saranac (S)		0.3	"			
	SCORING SYSTEM: Percent surviving seedlings. Data adjusted to Arc at 65% resistant plants by Pioneer Hi-Bred International, Inc.						
Anthracnose, Race 2 *(Collectotrichum trifolii)*	Application R	1	43.2	Approx 300		Percent Resistant Plants 7.4	Pioneer Hi-Bred International, Inc. 1988 Quarryville, PA Laboratory
	Saranac AR (R)		55.0	"			
	Arc (S)		1.8	"			
	SCORING SYSTEM: Percent surviving seedlings. Data adjusted to Saranac AR at 55% resistant plants by Pioneer Hi-Bred International, Inc.						
Bacterial Wilt *(Corynebacterium insidiosum)*	Application HR	1	55.7	Approx 225	5.3	ASI 0.62 Percent Resistant Plants 20.9	Pioneer Hi-Bred International, Inc. 1987 Arlington, WI Field
	Vernal (R)		42.0	"	4.3		
	Narragansett (S)		2.5	"	2.8		
	SCORING SYSTEM: Plants scored 7-9 (on a 1-9 scale, where 9=no symptoms and 1= dead plant) considered resistant. Data adjusted to Vernal at 42% resistant plants by Pioneer Hi-Bred International, Inc.						
Common Leafspot *(Pseudopeziza medicaginis)*	Application						
	MSA-CW3AN3 (R)						
	Ranger (S)						
	SCORING SYSTEM:						

10. A. PEST RESISTANCE (Continued):

DISEASE	VARIETY	SYN. GEN. TESTED	PERCENT RESISTANT PLANTS	NUMBER OF PLANTS TESTED	ASI	ASI LSD .05	INSTITUTION, YEAR, LOCATION, FIELD OR LABORATORY
Downy Mildew *(Peronospora trifoliorum)*	Application R	1	16.7	Approx 200		Percent Resistant Plants 8.6	Kansas State University 1989 Manhattan, KS Laboratory
Isolate, if known: I-7 (Kansas)	Saranac (R)		14.6	"			
	Kanza (S)		0.0	"			
	SCORING SYSTEM: Percent symptomless plants						
Fusarium Wilt *(Fusarium oxysporum f. medicaginis)*	Application HR	2	63.5	Approx 225	2.04	Percent Resistant Plants 14.08 ASI 0.60	University of Minnesota 1990 Rosemount, MN Field
	Agate ~~Moapa 69~~ (R)		54.0	"	2.40		
	Narragansett (R) (MR)		29.0	"	3.48		
	MNGN-1 (S)		5.0	"	4.58		
	SCORING SYSTEM: Plants scored 0 and 1 (on a 1-5 scale, where 0=no disease and 5= dead plant) considered resistant. Data adjusted to Agate at 54% resistant plants by the University of Minnesota						
Phytophthora Root Rot *(Phytophthora megasperma f. medicaginis)*	Application R	2	43.5	Approx 225	6.12	Percent Resistant Plants 11.9 ASI 0.86	Pioneer Hi-Bred International, Inc. 1990 Arlington, WI Field
	Agate (R)		43.0	"	6.14		
	Saranac (S)		3.9	"	2.70		
	SCORING SYSTEM: Plants scored 7-9 (on a 1-9 scale, where 9=no symptoms and 1= dead plant) considered resistant. Data adjusted to Agate at 43% resistant plants by Pioneer Hi-Bred International, Inc.						
Verticillium Wilt *(Verticillium alboatrum)*	Application MR	2	22.3	Approx 200	2.28	Percent Resistant Plants 14.9 ASI 0.55	Pioneer Hi-Bred International, Inc. 1989 Arlington, WI Laboratory
	Vertus (R)		40.0	"	3.16		
	Saranac (S)		2.2	"	1.60		
	SCORING SYSTEM: Plants scored 7-9 (on a 1-9 scale, where 9=no symptoms and 1=dead plant) considered resistant. Data adjusted to Vertus at 40% resistant plants by Pioneer Hi-Bred International, Inc.						
Other *(Specify)*	Application						
	(R)						
	(S)						
	SCORING SYSTEM:						
Other *(Specify)*	Application						
	(R)						
	(S)						
	SCORING SYSTEM:						

B. INSECT RESISTANCE:

INSECT	VARIETY	SYN. GEN. TESTED	PERCENT DEFOLIATION	DEFOLIATION IN PERCENT OF RESISTANT CHECK	ASI	ASI LSD .05	INSTITUTION, YEAR, LOCATION, FIELD OR LABORATORY
Alfalfa Weevil *(Hypera postica)*	Application						
	Arc (R)			100			
	Saranac (S)						
	SCORING SYSTEM:						

10. B. INSECT RESISTANCE (Continued):

INSECT	VARIETY	SYN. GEN. TESTED	PERCENT SEEDLING SURVIVAL	NUMBER OF SEEDLINGS TESTED	ASI	ASI LSD .05	INSTITUTION, YEAR, LOCATION, FIELD OR LABORATORY
Blue Alfalfa Aphid *(Acyrthosiphon kondoi)*	Application						
	CUF 101 (R)						
	PA-1 (S)						
	SCORING SYSTEM:						
Pea Aphid *(Acyrthosiphon pisum)*	Application HR	1	54.5	Approx 300		Percent Resistant Plants 17.9	Pioneer Hi-Bred International, Inc. 1987 Johnston, IA Laboratory
	Baker (HR) Kanza (R)		70.0	"			
	Kanza (R)		24.0	"			
	Ranger (S)		8.6	"			
	SCORING SYSTEM: Plants scored 5-9 (on a 1-9 scale, where 9=no symptoms and 1=dead or severely stunted plant) considered resistant. Data adjusted to Baker at 70% resistant plants by Pioneer Hi-Bred International, Inc.						
Spotted Alfalfa Aphid *(Therioaphis maculata)* Biotype, if known:	Application R	1	39.6	Approx 250		Percent Resistant Plants 18.9	Pioneer Hi-Bred International, Inc. 1987 Kerman, CA Laboratory
	Kanza (R)		70.0	"			
	Ranger (S)		0.0	"			
	SCORING SYSTEM: Plants scored 7-9 (on a 1-9 scale, where 9=no symptoms and 1=dead plant) considered resistant. Data adjusted to Kanza at 70% resistant plants by Pioneer Hi-Bred International, Inc.						

INSECT	VARIETY	SYN. GEN. TESTED	PERCENT RESISTANT PLANTS	NUMBER OF PLANTS TESTED	ASI	ASI LSD .05	INSTITUTION, YEAR, LOCATION, FIELD OR LABORATORY
Potato Leafhopper Yellowing *(Empoasca fabae)*	Application						
	MSA-CW3An3 (R)						
	Ranger (S)						
	SCORING SYSTEM:						
Other *(Specify)*	Application						
	(R)						
	(S)						
	SCORING SYSTEM:						

C. NEMATODE RESISTANCE: NEMATODE	VARIETY	SYN. GEN. TESTED	PERCENT RESISTANT PLANTS	NUMBER OF PLANTS TESTED	ASI	ASI LSD .05	INSTITUTION, YEAR, LOCATION, FIELD OR LABORATORY
Northern Root Knot *(Meloidogyne hapla)*	Application						
	Nev. Syn. XX (R)						
	Lahontan (S)						
	SCORING SYSTEM:						

10. C. NEMATODE RESISTANCE (Continued):

NEMATODE	VARIETY	SYN. GEN. TESTED	PERCENT RESISTANT PLANTS	NUMBER OF PLANTS TESTED	ASI	ASI LSD .05	INSTITUTION, YEAR, LOCATION, FIELD OR LABORATORY
Southern Root Knot *(Meloidogyne incognita)*	Application						
	Moapa 69 (R)						
	Lahontan (S)						
	SCORING SYSTEM:						
Stem Nematode *(Ditylenchus dipsaci)*	Application LR	2	21.4	Approx 225	2.78	ASI 0.78 Percent Resistant Plants 23.7	Pioneer Hi-Bred International, Inc. 1989 Connell, WA Laboratory
	Lahontan (R)		50.0	"	3.50		
	Ranger (S)		15.2	"	3.06		
	SCORING SYSTEM: Plants scored 7-9 (on a 1-9 scale, where 9=no symptoms and 1=dead plant) considered resistant. Data adjusted to Lahontan at 50% resistant plants by Pioneer Hi-Bred International, Inc.						
Other *(Specify)*	Application						
	(R)						
	(S)						
	SCORING SYSTEM:						

11. INDICATE THE VARIETY THAT MOST CLOSELY RESEMBLES THE APPLICATION VARIETY FOR EACH OF THE FOLLOWING CHARACTERS:

CHARACTER	VARIETY	CHARACTER	VARIETY
Winterhardiness	532	Plant Color	–
Recovery After 1st Cut	Saranac	Crown Type	–
Area of Adaptation	532	Combined Disease Resistance	5331
Flowering Date	–	Combined Insect Resistance	5472

REFERENCES

Barnes, D.K. 1972. A System for Visually Classifying Alfalfa Flower Color. U.S. Dep. Agric. Handb. 424. 18 pp. (Note: Greenish cast of plate 6, A and B is an artifact of printing, actual colors a blend of yellow and white.)

Elgin, J.H., Jr., (ed.). 1982. Standard Tests to Characterize Pest Resistance in Alfalfa Cultivars. U.S. Dep. Agric. Tech. Bull. (In Press).

Gunn, C.R., W.H. Skrdla, and H.C. Spencer. 1978. Classification of Medicago sativa L. using legume characters and flower colors. U.S. Dep. Agric. Tech. Bull. 1574. 84 pp.

Munsell Color Co. 1977. Munsell Plant Tissue Color Charts. Munsell Color Co., Inc. Baltimore.

NOTE: Any additional descriptive information and supporting documentation may be provided as Exhibit D.

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EXHIBIT D

'5333'

9100156

APPLICATION FOR REVIEW OF ALFALFA VARIETIES FOR CERTIFICATION
National Alfalfa Variety Review Board

(The criteria for evaluation of applications were developed by the Joint Alfalfa Work conference and the Association of Official Seed Certifying Agencies.)

Applicant's Name: Pioneer Hi-Bred International, Inc. Date: 11/6/90
Address: P. O. Box 287, Johnston, IA 50131
Sponsoring Institution (if other than applicant) _____
Breeder's Name (if other than applicant) _____
Variety Name: 5333 Experimental Designation: XAM84, YAM84, 86SV821

Applicant's Signature William T. Woodward

The breeder or sponsoring institution or organization must describe and DOCUMENT in this application those characteristics of the variety which give it distinctiveness and merit by supplying the information requested below. Information must be supplied for each category excepting those listed as optional. Action will be deferred unless the application is sufficiently documented.

At the time a variety is accepted for certification, a seed sample of the generation or generations requested by the certifying agency shall be submitted to the certifying agency by the sponsor. This lot(s) is to be retained as a control sample against which all future seed stocks released for certified seed production may be compared to establish continued trueness of variety.

I. A. Estimate the % of the germplasm sources listed below that contribute to the major genetic constitution of this variety.

M.falcata	Ladak	M.varia	Turkistan	Flemish	Chilean
6	10	27	6	27	6
Peruvian	**Indian**	**African**	**Arabian**	**Unknown**	
				18	

B. A statement of origin (including variety names, germplasm releases and/or PI numbers, and the number of plants or % contribution from each) and the breeding procedures or methods and selection criteria used in developing the variety. Include the procedure for producing breeder seed, the generation (e.g. Syn 1, Syn 2, etc.) that is considered breeder seed, and the year of breeder seed production.

5333 is a synthetic variety comprised from 145 plants originating from experimental lines tracing to 5432 (10%), 532 (7%), 120 (7%), 524 (6%), NCMP10 (6%), MSACW3AN4 (4%), Vernal (5%), Armor (3%), Magnum (3%), Mercury (2%), 5444 (2%), Apollo (2%), 521 (2%), Agate (2%), Endure (1%), Futura (1%), 526 (1%), 5364 (1%), 555 (1%), B7AC3AN1 (1%). The remainder trace through Pioneer experimentals to Honeoye, Europe, Vertus, Daer Feldt, Culver, MSA-C4, MSB-C4, 520, Iroquois, Narragansett, Team, Cherokee, Arnim, Saranac AR, Dawson, Anchor, DuPuits, 530, 521 and others with minor contributions. Parent plants were selected through phenotypic recurrent selection from various experimental populations for one or more of the following: Bacterial wilt, Fusarium wilt, anthracnose, Verticillium wilt, Phytophthora root rot and expression of multifoliolate leaves. Syn 1 seed harvested from parental plants in 1986 and 1987 in cage isolation is considered breeder seed.

C. **Seed class to be used, limitations on age of stand and areas of production for each class.**

Seed Class	Synthetic Generation	Length of Stand Allowed	Limitation on Areas for Seed Production
Breeder	1	Two	None
Foundation	2 or 3	Three	None
Certified	2, 3, or 4	Five	None

Only the synthetic generations given for the above seed classes are recognized as representing this variety. (No supporting data should be used in this application from Syn. generations other than those for the Breeder, Foundation and Certified Classes listed here).

D. **Procedures for maintaining seed stock:**

Breeder seed (Syn 1) produced on 145 plants in cage isolation in 1986 and 1987 was bulked. Seed classes will be breeder, foundation and certified. Foundation seed may be produced from breeder or foundation. The second generation foundation seed may be produced at the discretion of Pioneer Hi-Bred International, Inc. Both breeder and foundation seed will be maintained by Pioneer Hi-Bred International, Inc. Certified seed may be produced from breeder or foundation.

E. Any other requirements or limitations necessary to maintain varietal characteristics?

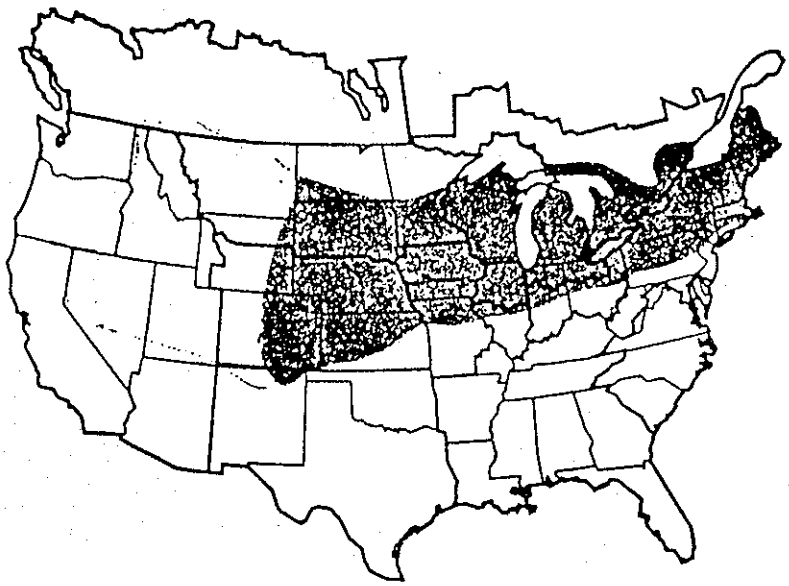
None

II. A. Describe the primary use of this variety (if for uses other than hay, haylage, greenchop or dehydration):

B. List states and areas within states where tested for forage and\or persistence. (Present data from each location in III.A. and III.B.).

Johnston, IA; Toledo, IA; Davis, IL; Princeton, IL; Buckeystown, MD; Owatonna, MN; Phelps, NY, Hermiston, OR; Lancaster, PA; Quarryville, PA; Connell, WA; Moses Lake, WA; Appleton, WI; Arlington, WI; Eau Claire, WI; Markesan, WI.

C. Indicate proposed areas of adaptation and intended use on the map below.



III. Evidence of agronomic performance, including data on yield (in T/A) and persistence. Data may be from tests conducted by private firms, Agricultural Experiment Stations or USDA.

A. Minimum required forage yield data is six location years with at least two locations (two locations must be at least 100 miles apart). Seeding year forage yield data cannot be used to satisfy this requirement. One location must have at least two harvest years beyond seeding year. Each harvest year should be listed separately.

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Note: For non-dormant varieties (dormancy level of Moapa 69 or CUF 101) seeding year data may be accepted for up to two of the six location years when four or more cuttings are made in the seeding year.

Summarize Forage Yield Data below:

Test Location	Date Plntd Mo/Yr	Syn Gen	Year Hvst	No. Cuts	Test Variety	Total Yield (DM T/A) 2.a.	3.b.	4.c.	LSD .05	CV
APPLETON, WI	5/88	1	89	3	5.1	3.6	3.5	3.3	0.09	12.2
	5/88	1	90	3	7.3	5.8	5.8	6.9	0.79	6.8
ARLINGTON, WI	4/87	1	88	4	5.8	5.4	6.3	6.0	0.79	8.2
	4/87	1	89	4	5.7	5.4	6.1	6.2	0.94	7.9
ARLINGTON, WI	4/88	1	89	4	4.5	4.6	4.8	4.5	0.42	5.5
	4/88	1	90	4	7.1	6.3	7.1	7.7	0.54	4.4
BUCKEYSTOWN, MD	4/87	1	88	5	6.3	5.2	5.4	6.0	0.68	6.5
	4/87	1	89	3	4.6	3.8	3.9	4.4	0.70	8.6
CONNELL, WA	4/87	1	88	4	8.9	7.5	9.0	8.8	0.54	3.6
	4/87	1	89	4	6.9	6.2	6.8	7.9	0.86	7.6
CONNELL, WA	4/88	1	89	5	10.7	9.8	11.1	11.6	1.00	5.5
	4/88	1	90	5	8.4	8.0	8.3	9.0	0.61	4.2
DAVIS, IL	4/87	1	88	1	3.0	2.8	3.0	3.0	0.28	5.8
	4/87	1	89	1	1.8	1.6	1.5	2.0	0.32	11.2
DAVIS, IL	4/88	1	89	3	4.7	4.2	4.6	4.8	0.54	5.6
EAU CLAIRE, WI	5/87	1	88	2	3.6	2.9	3.5	4.1	0.70	12.9
HERMISTON, OR	4/87	1	88	5	9.9	7.6	9.2	10.1	1.43	8.8
	4/87	1	89	5	7.4	5.8	5.6	8.5	1.14	9.2
HERMISTON, OR	4/88	1	89	5	9.8	8.7	9.5	9.8	1.19	7.4
	4/88	1	90	5	7.5	6.9	6.8	8.1	1.32	10.4
JOHNSTON, IA	4/87	1	88	4	5.9	4.9	5.0	6.2	0.96	10.8
	4/87	1	89	4	6.4	6.3	6.8	7.1	1.01	9.5
JOHNSTON, IA	4/88	1	89	4	7.2	6.8	6.7	7.0	0.77	6.6
	4/88	1	90	3	5.8	5.1	5.6	5.7	0.66	7.0
LANCASTER, PA	4/87	1	88	4	6.4	5.3	5.5	6.0	0.63	6.2
	4/87	1	89	4	3.7	2.8	2.8	3.3	0.53	9.2
LANCASTER, PA	4/88	1	89	4	4.5	2.8	3.1	2.7	0.63	10.0
	4/88	1	90	4	6.5	3.7	3.3	4.1	0.80	8.4
MARKESAN, WI	5/87	1	88	4	3.7	3.1	2.7	3.4	0.78	14.6
	5/87	1	89	4	8.0	6.8	7.1	8.0	0.54	4.3
MARKESAN, WI	5/88	1	89	4	7.0	6.1	6.4	7.1	0.64	4.5
	5/88	1	90	4	7.4	5.0	5.7	7.2	0.87	6.0
MOSES LAKE, WA	4/87	1	88	5	11.0	9.6	10.2	10.7	0.81	4.5
	4/87	1	89	5	8.7	7.7	7.8	8.1	1.38	10.3
MOSES LAKE, WA	4/88	1	89	5	9.6	8.8	8.8	9.8	1.28	8.4
	4/88	1	90	5	8.5	7.6	7.9	9.0	0.82	5.8
OWATONNA, MN	5/87	1	88	3	3.0	3.1	2.6	3.6	0.58	11.1
	5/87	1	89	3	5.5	4.9	5.2	5.9	0.56	6.3

Forage Yield Data cont.

Test Location	Date Plntd Mo/Yr	Syn Gen	Year Hvst	No. Cuts	Test Variety	Total Yield (DM T/A) 2.a.	3.b.	4.c.	LSD .05	CV
OWATONNA,	5/88	1	89	3	5.2	4.8	4.5	4.8	0.59	7.7
MN	5/88	1	90	2	5.1	4.3	4.2	5.1	0.75	10.1
PHELPS,	4/87	1	88	2	4.4	3.8	4.3	4.5	0.43	5.9
NY	4/87	1	89	4	6.3	5.5	5.3	6.5	0.51	4.9
PHELPS,	4/88	1	89	4	4.8	4.2	4.6	5.0	0.67	7.9
NY	4/88	1	90	4	4.6	3.9	3.6	4.6	0.54	7.1
PRINCETON,	4/87	1	88	5	8.0	7.6	8.2	8.3	0.86	6.3
IL	4/87	1	89	4	6.6	5.7	6.6	7.4	0.56	5.1
PRINCETON,	4/88	1	89	3	4.3	4.6	4.3	4.6	0.37	5.1
IL	4/88	1	90	4	7.2	6.2	6.6	6.9	0.65	5.6
QUARRYVILLE,	4/87	1	88	5	7.5	5.4	6.0	6.7	0.55	4.7
PA	4/87	1	89	5	6.6	4.3	4.6	5.5	0.65	6.4
QUARRYVILLE,	4/88	1	89	5	5.8	4.4	4.7	5.5	0.55	5.5
PA	4/88	1	90	5	5.2	3.5	3.3	4.4	0.53	6.4
TOLEDO,	4/87	1	88	4	5.1	4.6	4.9	5.3	0.68	8.0
IA	4/87	1	89	4	6.6	5.6	6.0	6.3	0.51	4.7
TOLEDO,	4/88	1	89	4	6.9	6.1	6.5	6.4	0.62	5.7
IA	4/88	1	90	4	6.0	5.2	5.0	5.9	1.19	12.2

2.a. Vernal
3.b. Saranac
4.c. 526

	Years Hvstd	Total No.of Hvsts	Mean Annual Yield			
Ck 2 comparison	56	219	6.3	5.4		
Ck 3 comparison	56	219	6.3		5.7	
Ck 4 comparison	56	219	6.3			6.3

B. Persistence (winter and drought tolerance, summer survival relative to check varieties). Enter dates of both Initial and Final stand estimates. Data must come from the area of adaptation and from stands at least two years old. More than one location must be given either when persistence is a trait used to justify release or when large diverse geographic areas of adaption are recommended.

Test Loc.	Syn Gen	Date Seeded	Yrs. Hvtd	No. Hvts	Date of Readings In/Fnl	%Stand Test Variety In/Fnl	%Stand Check Varieties VERNAL In/Fnl	%Stand Check Varieties 526 In/Fnl	LSD .05	CV%
JH	1	4/87	2	8	6-87/10-89	99/93	99/90	100/92	5.11	3.31
MN	1	5/87	2	6	7-87/10-89	90/80	95/88	97/87	12.40	8.38
IA	1	4/87	2	8	6-87/10-89	99/98	99/95	99/98	2.74	1.73
NY	1	4/87	2	6	6-87/10-89	100/93	99/89	100/86	4.66	1.70
LAN	1	4/87	2	8	6-87/10-89	98/80	99/54	100/55	16.97	16.15
MD	1	4/87	2	8	6-87/10-89	100/68	99/39	100/39	17.93	19.87
QV	1	4/87	2	10	6-87/10-89	100/93	100/79	100/87	5.32	3.56
OR	1	4/87	2	10	6-87/10-89	98/65	94/46	99/58	14.09	13.94
WA	1	4/87	2	8	6-87/10-89	99/94	98/94	99/96	11.07	7.33
ML	1	4/87	2	10	6-87/10-89	99/81	99/86	99/85	16.59	13.02
MA	1	5/87	2	8	7-87/10-89	99/92	96/94	97/94	5.82	3.80
WI	1	4/87	2	8	6-87/10-89	96/91	97/95	95/95	6.97	3.70

JH=JOHNSTON, IA; MN=OWATONNA, MN; IA=TOLEDO, IA; NY=PHELPS, NY; LAN=LANCASTER, PA; MD=BUCKEYSTOWN, MD; QV=QUARRYVILLE, PA; OR=HERMISTON, OR; WA=CONNELL, WA; ML=MOSES LAKE, WA; MA=MARKESAN, WI; WI=ARLINGTON, WI.

Scoring System used: Missing six inch units within each plot converted to % stand using a plot size of 120 units.

C. **Fall dormancy relative to recognized varieties; check varieties must be chosen so as to bracket the dormancy data of this variety.**

1. Test data

Test Location	Syn Gen	Date Last Cut	Date Measured	Score or average height Test Variety	Check Varieties Vernal	Check Varieties Ranger	Check Varieties Saranac	LSD .05	CV%
Johnston, IA	2	9/14/90	10/12/90	11.2	8.4	9.7	11.8	1.4	10.0

Scoring system used: Average height in cm of space plants

2. Indicate which of the following check varieties this variety most nearly compares to in fall dormancy.

VERY DORMANT	DORMANT	MOD. DORMANT	NON-DORMANT	VERY NON DORMANT
Norseman ( )	Vernal ( )	Saranac (X)	Mesilla ( )	CUF 101 ( )
	Ranger ( )	DuPuits ( )	Moapa 69 ( )	
		Lahontan ( )		

D. Seed production (this information optional).

Variety	Syn Gen	Test Location	Years Tested	Average Yield (lbs/A)
Test variety				
1.		Not Tested		
2.				

IV. Other descriptive characteristics

A. Flower color at full bloom. Syn generation observed 2 (see USDA Agriculture Handbook No. 424 - A System for Visually Classifying Alfalfa Flower Color).

88 % purple	t % cream	t % yellow
12 % variegated	t % white	

B. Growth habit: (erect, semi-erect or decumbent)

Mid summer Erect
Fall Semi-erect

C. Optional: (Document distinctive characteristics such as pod, leaf or root traits, biochemical markers, etc.)

Table 1: Number of multifoliolate stems and average number of leaflets/leaf for 5333 sampled September 14, 1989, at Johnston, IA.

Rep	% Mulifoliolate stems	Average Number Leaflets/Leaf	Number stem Samples
1	44.2	3.35	118
2	54.7	3.34	138
3	49.4	3.31	129
Average	49.4	3.33	128

A stem was considered multifoliolate if at least one leaf consisted of more than one leaflet. One stem sampled every six inches in each plot.

Table 2: Number of multifoliolate space plants of 5333 sampled fall, 1989, at Connell, WA.

Sample	No. of Plants	No. of plants Expressing multi-foliolate leaves	% Plants expressing multifoliolate leaves
1	120	72	60.0
2	106	44	41.5
3	101	51	50.5
4	100	45	45.0
5	96	47	49.0
Total	523	259	49.5

An average of 49.5% of 523 plants expressed at least one multifoliolate leaf under space plant conditions.

Table 3: Percent plants of 5333 expressing multifoliolate leaves under greenhouse space plant conditions in October, 1990, at Johnston, IA.

No. of Plants Observed	Number of Plants Expressing Trait	% Multifoliolate Plants
350	193	55.1%

55.1% of the plants expressed at least one multifoliolate leaf.

V. Pest Resistance Characteristics

PLEASE FOLLOW THESE INSTRUCTIONS CAREFULLY WHEN REPORTING PEST RESISTANCE RESULTS.

Furnish comparative data on the following insects and diseases (and others where applicable) for your variety. Data may be from tests conducted by private firms, Agricultural Experiment Stations, or USDA. Tests should be conducted by standard procedures as described in ARS Misc. publication 1434. Each disease and insect test must include recognized resistant and susceptible checks. Statistics must include the test mean (mean of all entries in test), LSD (.05), and CV (%). Resistance levels should be characterized using % resistant plants as follows: S=<6%, LR=6-14%, MR=15-30%, R=31-50%, HR=>50%. Do not refer to tolerance. Checks should be characterized based on long term % resistance averages published in ARS Misc. publication 1434.

If data for the resistant check does not fit its expected resistance class (MR, R, HR, etc.) data must be adjusted to the long term mean. If data has been adjusted, supply both adjusted and unadjusted values and indicate how and by whom the adjustment was made.

At the time a variety is accepted for certification, a seed sample of the generation or generations requested by the certifying agency shall be submitted to the certifying agency by the sponsor. This lot(s) is to be retained as a control sample against which all future seed stocks released for certified seed production may be compared to establish continued trueness of variety.

If a scoring or rating system is used, specify the limits and meaning of scores. NOTE: If a pest reaction of the variety falls on or just above a resistance category level (+2% for LR, MR, and R; +3% for HR) and the higher rating is claimed, results of a second test must be reported. If the two tests do not agree, the lower rating is appropriate unless further testing supports the higher rating. Pest resistance data must be submitted on at least six of the following nine pests: anthracnose, bacterial wilt, Fusarium wilt, Verticillium wilt, Phytophthora root rot, stem nematode, pea aphid, spotted alfalfa aphid, and blue alfalfa aphid. For the pests where no data is available write "Not tested". The six required pests must be selected from those that frequently cause significant losses on susceptible cultivars in the area of proposed adaptation of this variety. (Use the map you have shaded in IIc and compare with the maps of distribution and severity of alfalfa pests in ARS Misc. publication 1434. This will determine for which pests you must submit resistance information). Show generation of seed used for each test.

ANTHRACNOSE (Race 1)

Test conducted by Pioneer Hi-Bred International, Inc. at Johnston, IA

Variety	Resistance Class	Year Tested	Syn Gen	Unadjusted % Resist.	Adjusted % Resist.	Score or A.S.I.
Test Variety	HR	1986	1	73.9	81.7	
1. ARC	HR			58.8	65.0	
2. Saranac AR	R			44.2	48.8	
3. Saranac	S			0.3	0.3	
Test Mean:				23.2	25.6	
L.S.D. (.05)				7.1	7.8	
C.V. (%)				19.0	19.0	

Scoring system used: % surviving seedlings; ~100 plants/rep; 3 replications. Data adjusted to ARC at 65% resistant plants by Pioneer Hi-Bred International Inc.

BACTERIAL WILT

Test conducted by Pioneer Hi-Bred International, Inc. at Arlington, WI

Variety	Resistance Class	Year Tested	Syn Gen	Unadjusted % Resist.	Adjusted % Resist.	Score or A.S.I.
Test Variety	HR	1987	1	29.3	55.7	5.3
1. Vernal	R			22.1	42.0	4.3
2. Narragansett	S			1.3	2.5	2.8
3.						
Test Mean:				30.3	57.6	4.80
L.S.D. (.05)				11.0	20.9	0.62
C.V. (%)				23.0	23.0	8.00

Scoring system used: Plants scored 7-9 (on a 1-9 scale, where 9=no symptoms and 1=dead plant) considered resistant. Data Adjusted to Vernal at 42% resistant plants by Pioneer Hi-Bred International, Inc.

FUSARIUM WILT

Test conducted by University of Minnesota at Rosemount, Minnesota

Variety	Resistance Class	Year Tested	Syn Gen	Unadjusted % Resist.	Adjusted % Resist.	Score or A.S.I.
Test Variety	HR	1990	2	65.9	63.5	2.04
1. Agate	HR			56.0	54.0	2.40
2. Narragansett	MR			30.0	29.0	3.48
3. MNGN-1	S			5.2	5.0	4.58
Test mean:				52.5	50.6	2.45
L.S.D. (.05)				14.60	14.08	0.60
C.V. (%)				17.25	17.25	15.20

Scoring system used: Plants scored 0 and 1 (on a 1-5 scale, where 0=no disease and 5=dead plant) considered resistant. Data adjusted to Agate at 54% resistant plants by the University of Minnesota.

VERTICILLIUM WILT

Test conducted by Pioneer Hi-Bred International, Inc. at Arlington, WI

Variety	Resistance Class	Year Tested	Syn Gen	Unadjusted % Resist.	Adjusted % Resist.	Score or A.S.I.
Test Variety	MR	1989	2	17.3	22.3	2.28
1. Vertus	R			31.0	40.0	3.16
2. Vernal	S			2.8	3.6	1.61
3. Saranac	S			1.7	2.2	* 4.80 1.60
Test mean:				19.9	25.7	2.60
L.S.D. (.05)				11.6	14.9	0.55
C.V. (%)				47.0	47.0	17.00

Scoring system used: Plants scored 7-9 (on a 1-9 scale, where 9=no symptoms and 1=dead plant) considered resistant. Data adjusted to Vertus at 40% resistant plants by Pioneer Hi-Bred International, Inc.

* This number should be 1.60. Error occurred on the NAFTA application.

PHYTOPHTHORA ROOT ROT

Test conducted by Pioneer Hi-Bred International, Inc. at Arlington, WI

Variety	Resistance Class	Year Tested	Syn Gen	Unadjusted % Resist.	Adjusted % Resist.	Score or A.S.I.
Test Variety	R	1990	2	58.7	43.5	6.12
1. Agate	R			58.0	43.0	6.14
2. Saranac	S			5.3	3.9	2.40
3.						
Test mean:				46.5	34.5	5.50
L.S.D. (.05)				16.1	11.9	0.86
C.V. (%)				25.0	25.0	11.00

Scoring system used: Plants scored 7-9 (on a 1-9 scale, where 9=no symptoms and 1=dead plant) considered resistant. Data adjusted to Agate at 43% resistant plants by Pioneer Hi-Bred International, Inc.

STEM NEMATODE

Test conducted by Pioneer Hi-Bred International, Inc. **at** Connell, WA

Variety	Resistance Class	Year Tested	Syn Gen	Unadjusted % Resist.	Adjusted % Resist.	Score or A.S.I.
Test Variety	LR	1989	2	6.3	21.4	2.78
1. Lahontan	R			14.7	50.0	3.50
2. Ranger	S			4.5	15.2	3.06
3.						
Test mean:				9.1	30.9	2.90
L.S.D. (.05)				6.9	23.7	0.78
C.V. (%)				55.0	55.0	19.00

Scoring system used: Plants scored 7-9 (on a 1-9 scale, where 9=no symptoms and 1=dead plant) considered resistant. Data adjusted to Lahontan a 50% resistant plants by Pioneer Hi-Bred International, Inc.

PEA APHID

Test conducted by Pioneer Hi-Bred International, Inc. **at** Johnston, IA

Variety	Resistance Class	Year Tested	Syn Gen	Unadjusted % Resist.	Adjusted % Resist.	Score or A.S.I.
Test Variety	HR	1987	1	35.6	54.5	
1. Baker	HR			45.7	70.0	
2. Kanza	HR			15.7	24.0	
3. Ranger	S			5.6	8.6	
4. Vernal	S			0.0	0.0	
Test mean:				30.9	47.3	
L.S.D. (.05)				11.7	17.9	
C.V. (%)				24.0	24.0	

Scoring system used: Plants scored 5-9 (on a 1-9 scale, where 9=no symptoms and 1=dead or severely stunted plant) considered resistant. Data adjusted to Baker at 70% resistant plants by Pioneer Hi-Bred International, Inc.

SPOTTED ALFALFA APHID

Test conducted by Pioneer Hi-Bred International, Inc. at Kerman, CA

Variety	Resistance Class	Year Tested	Syn Gen	Unadjusted % Resist.	Adjusted % Resist.	Score or A.S.I.
Test variety	R	1987	1	22.8	39.6	
1. CUF 101	HR			41.8	72.7	
2. Baker	HR			22.5	39.2	
3. Kanza	HR			40.2	70.0	
4. Caliverde	S			0.0	0.0	
5. Ranger	S			0.0	0.0	
6. Team	S			0.0	0.0	
Test mean:				20.9	36.4	
L.S.D. (.05)				10.9	18.9	
C.V. (%)				33.0	33.0	

Scoring system used: Plants score 7-9 (on a 1-9 scale, where 9=no symptoms and 1=dead plant) considered resistant. Data adjusted to Kanza at 70% resistant plants by Pioneer Hi-Bred International, Inc.

SPOTTED ALFALFA APHID

Test conducted by Pioneer Hi-Bred International, Inc. at Kerman, CA

Variety	Resistance Class	Year Tested	Syn Gen	Unadjusted % Resist.	Adjusted % Resist.	Score or A.S.I.
Test variety	R	1990	2	17.9	38.7	
1. CUF 101	HR			35.4	76.6	
2. Baker	HR			26.7	57.7	
3. Kanza	HR			32.4	70.0	
4. Caliverde	S			0.0	0.0	
5. Ranger	S			1.6	3.5	
6. Team	S			0.0	0.0	
Test mean:				21.2	45.9	
L.S.D. (.05)				12.8	27.7	
C.V. (%)				38.0	38.0	

Scoring system used: Plants score 7-9 (on a 1-9 scale, where 9=no symptoms and 1=dead plant) considered resistant. Data adjusted to Kanza at 70% resistant plants by Pioneer Hi-Bred International, Inc.

BLUE ALFALFA APHID

Test conducted by _____ at _____

Variety	Resistance Class	Year Tested	Syn Gen	Unadjusted % Resist.	Adjusted % Resist.	Score or A.S.I.
Test variety						
1.						
2.						
3.				NOT TESTED		
Test mean:						
L.S.D. (.05)						
C.V. (%)						

Scoring system used: _____

MISCELLANEOUS PEST ANTHRACNOSE (RACE II)

Test conducted by Pioneer Hi-Bred International, Inc. at Quarryville, PA

Variety	Resistance Class	Year Tested	Syn Gen	Unadjusted % Resist.	Adjusted % Resist.	Score or A.S.I.
Test variety	R	1988	1	35.1	43.2	
1. Saranac AR	R			44.7	55.0	
2. Arc	S			1.4	1.8	
3. Saranac	S			1.1	1.3	
Test mean:				7.4	9.2	
L.S.D. (.05)				6.0	7.4	
C.V. (%)				50.0	50.0	

Scoring system used: Percent surviving seedlings. Data adjusted to Saranac AR at 55% resistant plants by Pioneer Hi-Bred International, Inc.

Please attach a one page description/summary of your variety as you wish it published by AOSCA. This description must stand on its own; please use complete sentences.

Include the following:

1. A statement of genetic origin (including variety names, germplasm releases, and/or PI numbers that contributed to the major genetic constitution of this variety) and the breeding procedures, methods, and selection criteria used in developing the variety. Estimate the % of the major germplasm sources contributing to this cultivar (see I.A.)

2. Area of probable adaptation (geographic area) and primary purpose (hay, grazing, etc.) for which this variety will be used. Report states where the variety has been tested for yield and persistence and proposed areas of intended use.

3. Other descriptive characteristics such as flower color, fall dormancy, and other morphological or physiological identifying traits.

4. A statement relative to its resistance to anthracnose, bacterial wilt, Fusarium wilt, Verticillium wilt, Phytophthora root rot, stem nematode, pea aphid, spotted alfalfa aphid, and blue alfalfa aphid.

5. Procedures for maintaining seed stock, seed classes to be used, a statement as to the limitation of age of stand and generations that may be certified and other requirements or limitations necessary to maintain varietal characteristics.

6. If this variety is accepted by official certifying agencies, when will certified seed first be offered for sale?

7. Will application be made for protection under the Plant Variety Protection Act and if so, will the certification option be requested?

8. As a means of added varietal protection, are you willing to have the information in this application turned over to the PVP office?

1. 5333 in a synthetic variety comprised from 145 plants originating from experimental lines tracing to 5432, 532, 120, 524, NCMP10, MSACW3AN4, Vernal, Armor, Magnum, Mercury, 5444, Apollo, 521, Agate, Endure, Futura, 526, 5364, 555, B7AC3AN1, Honeoye, Europe, Vertus, Daer Feldt, Culver, MSA-C4, MSB-C4, 520, Iroquois, Narragansett, Team, Cherokee, Arnim, Saranac AR, Dawson, Anchor, DuPuits, 530, 531, and others with minor contributions. Parent plants were selected through phenotypic recurrent selection from various experimental lines for one or more of the following: Bacterial wilt, Fusarium wilt, anthracnose, Verticillium wilt, Phytophthora root rot and expression of multifoliolate leaves. Germplasm sources are: M.falcata (6%), Ladak (10%), M.varia (27%), Turkistan (6%), Flemish (27%), Chilean (6%), with (18%) unknown.

2. 5333 is adapted to and intended for use in the central and northern region of the United States for hay, haylage, greenchop and dehydration. The states in which 5333 have been tested are: Iowa, Illinois, Maryland, Minnesota, New York, Pennsylvania, Wisconsin, Oregon and Washington.

3. 5333 is a moderately dormant cultivar with fall dormancy similar to Saranac. Flower color in the Syn 2 generation is approximately 88% purple, 12% variegated and a trace of yellow, white and cream. Growth habit is erect in midsummer and semi-erect in the fall. Approximately 50% of the plants and/or stems express multifoliolate leaves in the field at full bloom.

4. 5333 has high resistance to anthracnose (race 1), bacterial wilt, Fusarium wilt, and pea aphids; resistance to anthracnose (race 2), Phytophthora root rot and spotted alfalfa aphid; moderate resistance to Verticillium wilt; low resistance to stem nematode. 5333 has not been tested for blue alfalfa aphid.

5. Breeder seed (Syn 1) was produced over a two year period on parent plants in "cage isolation" and bulked. Seed classes will be breeder, foundation (Syn 2 or Syn 3) and certified (Syn 2, Syn 3 or Syn 4). Foundation seed may be produced from breeder or foundation. The second generation foundation may be produced at the discretion of Pioneer Hi-Bred International, Inc. Limitations on ages of stand will be three and five years, respectively, for foundation and certified seed. Sufficient breeder and foundation seed for the projected life of the variety will be maintained by Pioneer Hi-Bred International, Inc.

6. Seed will be marketed in the spring of 1991.

7. Application for Plant Variety Protection will be made and the certification option will not be requested.

8. As a means of added varietal protection, information included with the Application for Review of Alfalfa Variety for Certification may be provided to the PVP office.

EXHIBIT E

STATEMENT OF THE BASIS OF APPLICANT'S OWNERSHIP

'5333'

Pioneer Hi-Bred International, Inc., Des Moines, Iowa, is the employer of the plant breeders involved in the development and evaluation of 5333. Pioneer Hi-Bred International, Inc. has the sole rights and ownership of 5333.